

# Materials for a Monograph of *Freycinetia* Gaud. (Pandanaceae) V. Singapore, Malaya and Thailand

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## Abstract

Eight species of *Freycinetia* Gaud. are reported from the Malayan Peninsula and adjacent Thailand and Singapore. This number is not any Peninsula and adjacent Thailand and Singapore. This number is hardly different from that given by Ridley (8) in his Flora of the Malay Peninsula; however he considered 7 of these as endemic species, while after considerable comparative study, it now appears that only one of his species is endemic, and that rather doubtfully. Hence, most of the binomial species names used in Ridley's Flora have had to be changed. In this paper keys, description, and synonymy are indicated; and one new species, and two new varietal taxa are proposed.

## Introduction

There are only eight species of *Freycinetia* Gaud. (1824) in the Malayan peninsula, Singapore, and the narrow Kra Peninsula of Thailand; thus the area stands in considerable contrast to regions to the east. Borneo has at least 24 species, the Philippines at least as many, and New Guinea more than 40 species. Furthermore, only one of the Malayan species is endemic, and that only tentatively. This is also in marked contrast to the three regions just mentioned, each of which has a concentration of endemic species. The Malayan species show the following distribution:

*F. javanica* — Malaya and the Kra Peninsula of Thailand; Sumatra; Borneo; Java.

*F. angustifolia* — Malaya, Sumatra, Borneo, Java, Philippines.

*F. corneri* — South Malaya (Johore), Singapore, Borneo.

*F. sumatrana* — Malaya and the Kra Peninsula of Thailand; Cambodia; Vietnam; Andaman Islands; Sumatra; Borneo; Java; Philippines.

*F. confusa* — Malaya; tentatively considered endemic, but extremely similar to *F. distigmata* of Sumatra; to be further studied.

*F. imbricata* — Malaya, Sumatra, Borneo, Java.

*F. rigidifolia* — Malaya, Andaman Islands, Borneo.

*F. kamiana* — Malaya, Sumatra.

The names used above, it will be seen, are nearly all different from those used by Ridley in the "Flora of the Malaya Peninsula" (Vol. 5, 1925). Ridley credited Malaya with eight species of *Freycinetia*, seven of which he considered endemic. But this

optimistic conclusion has not fared well, and in the light of monographic studies all but one of these species has turned out to be previously known and described from different regions. The synonymy in brief is as follows:

*F. javanica* Bl. (*F. lucens* Ridl.; *F. montana* Ridl.).

*F. angustifolia* Bl. (*F. angustifolia* Bl. sensu Ridl.; *F. malaccensis* Ridl.).

*F. corneri* Stone (not known to Ridley).

*F. sumatrana* Hemsl. ((*F. valida* Ridl.).

*F. confusa* Ridl. (endemic).

*F. imbricata* Bl. (*F. kingiana* Ridl.).

*F. rigidifolia* Hemsl. (*F. acuminata* Ridl.).

*F. kamiana* Stone (not known to Ridley).

In this paper a revision of the Malayan species, including those of adjacent Thailand and Singapore, is presented, with keys, brief descriptions, citations of specimens, field notes, and illustrations. Based upon three years of field work in Malaya and a tour of several European and American herbaria, it forms the fifth in a series antecedent to a monograph of the genus. I would like to express my thanks to the curators and directors of the museums and herbaria mentioned below for their cordial assistance.

- |      |                                                                    |
|------|--------------------------------------------------------------------|
| A    | The Arnold Arboretum, Harvard University, Cambridge, Mass., U.S.A. |
| BISH | B.P. Bishop Museum, Honolulu, Hawaii.                              |
| BM   | British Museum (Natural History), London.                          |
| CAL  | Indian Botanic Gardens' Herbarium, Howrah, Calcutta, India.        |
| E    | Royal Botanic Gardens, Edinburgh, Scotland.                        |
| FI   | Istituto Botanica, University of Florence, Florence, Italy.        |
| K    | Royal Botanic Gardens, Kew, Surrey, England.                       |
| KLU  | University of Malaya Herbarium, Kuala Lumpur, Malaysia.            |
| KEP  | Herbarium, Forest Research Institute, Kepong, Malaysia.            |
| L    | Rijksherbarium, Leiden, Netherlands.                               |
| SING | Botanic Gardens, Singapore.                                        |
| U    | University of Utrecht Herbarium, Utrecht, Netherlands.             |

I should also like to express my thanks to the Chairman of the School of Biological Sciences, University of Malaya for much assistance, and to a former student, Miss Tan Poey Keng, who undertook a very useful preliminary study of Malayan Freycinetiae.

## Systematic Treatment

### *Freycinetia* Gaudichaud

Ann. Sci. Nat. I, 3: 509. 1824. Solms-Laubach, Linnaea 1878-9.

Warburg, in Engler, Pflanzenreich IV. 9, 1900.

Ridley, Mat. Fl. Malay Penin. 2: 232-5. 1907; Fl. Malay Penin. 5: 82-84, 1925.

Lectotype species: *Freycinetia arborea* Gaud. 1824 (see Stone 1967).

Woody climbers with clasping adventitious roots. Leaves simple, arranged in 3 spiralled ranks, linear, oblong, elliptic, lanceolate or oblanceolate, commonly serrate-dentate along the margins and on the midrib dorsally. Leaf-base sheathing the stem, usually with membranous and caducous, or sometimes more or less permanent but fragile auricles. Inflorescence terminal on a main or a lateral branch, bracteate, and pedunculate, of 1 or more cephalia arranged umbellately or sometimes racemosely, often ternate, sometimes with up to 7 (very rarely more) unisexual cephalia; plants dioecious. Staminate spadix of crowded simple stamens, pistillodia sometimes present; anthers subglobose. Pistillate spadix of crowded gynoecea, baccate when ripe, with usually a rigid or coriaceous pileus; stigma single or up to 12 (rarely more) per berry, minute, microscopically papillate, often within a low rim. Seeds numerous on vertical placentae corresponding to each stigma, usually elliptic or hemi-elliptic to falcate, with a noticeable translucent raphe with some silvery raphidophorous cells, and sometimes a similar and opposite strophiole. Embryo minute, within endosperm.

Distribution: Asiatic and Pacific Tropics; west to Ceylon (not in India proper); Andaman Islands; Malayan Peninsula and Singapore; Sumatra; Borneo; Java; the Philippine Islands; Vietnam; Formosa (Taiwan); Ryukyu Islands; Bonin Islands; Micronesia; Melanesia; New Guinea; Australia (north Queensland); Norfolk Island; New Caledonia; New Zealand; Polynesia, including Hawaii, but not Easter Island.

The greatest concentration of species is in the regions of Borneo, Philippines, and New Guinea (including the Solomon Islands).

A genus of perhaps 150 species (estimated; there are far more binomials). The name commemorates Captain Louis de Freycinet, commander of the vessels "L'Uranie" and "Physicienne" of the French Exploring Expedition of 1816-1818.

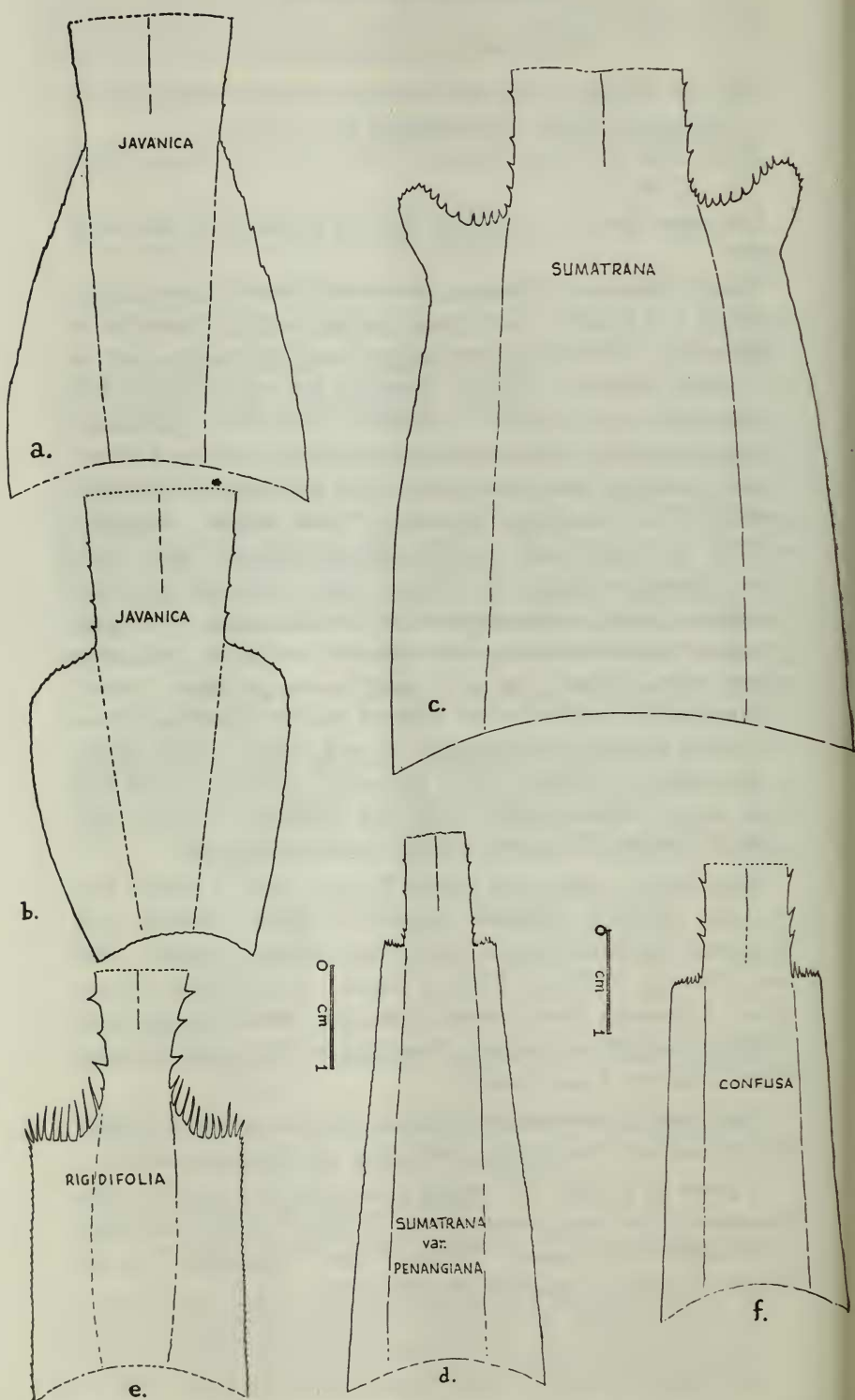


Fig. 1. Auricles of Malayan Freycinetiae. a-b : *F. javanica*. c — *F. sumatrana*. d — *F. sumatrana* var. *penangiana*. e — *F. rigidifolia*. f — *F. confusa*. (All from cited specimens). To same scale.

## KEYS TO MALAYAN SPECIES OF FREYCINETIA

I. Field Key for Sterile or Staminate Plants Based  
Principally on Vegetative Characters

(1) Auricles caducous, relatively short and broad, not or rarely more than 6 cm long, tapered or rounded at apex, without a free apical lobe, entire or minutely and sparsely weakly denticulate; leaves to about 30 cm long.

(2) Leaves elliptic, to oblong or oblanceolate, definitely narrowed at base, acute-acuminate, not drawn out to a filiform-flagellate tip, to 30–40 cm long and 3–5–8 cm wide, though usually smaller; spadices umbellate.

(3) Pedicels  $\frac{1}{2}$ – $\frac{1}{3}$  as thick as long; leaves elliptic, hardly or not caudate ..... 1 *F. javanica*

(3) Pedicels much more slender; leaves oblong, caudate ..... 8 *F. kamiana*

(2) Leaves narrowly linear, up to 30 cm long but rarely more than 1 cm wide, apex gradually attenuate-filiform, base not or scarcely narrowed; spadices racemose ..... 2 *F. angustifolia*

(1) Auricles subpersistent but fragmenting and eventually lost, usually more than 3 cm long, sometimes much more (18 cm), sometimes with a free apical lobe, otherwise with a truncate apex, usually slightly to manifestly denticulate on the margins and/or apex; leaves sometimes over 1 m long.

(4) Robust plants, stems (adults) often exceeding 15 mm diameter, leaves commonly over 50 cm long, up to 1 m (or more); auricles mostly more than 5 cm long, up to 15–18 cm long, with a distinct apical lobe to 1 cm long (in *F. sumatrana*) or a blunt truncate apex.

(5) Leaf apex acute, not drawn out; auricles to 9 cm long and 1–2 cm wide, truncate or slightly rounded at apex. Teeth of basal leaf-margin broadly deltoid (to 2 mm long and 2 mm wide), rather distinct (c. 1 cm apart). Pistillate cephalia subglobose, on glabrous pedicels, berry with 3–8 stigmas ..... 3 *F. corneri*

(5) Leaf apex gradually attenuate, subflagellate; auricles to 10 (or to 18) cm long, 1–1.5 cm wide, apex with a narrow free ascending lobe, usually denticulate on margin; teeth of basal leaf margin slender, antrorse, usually less than 2 mm long and 1 mm wide. Pistillate cephalia cylindric, on minutely scabrid pedicels; berry with 2 (rarely 1 or 3) stigmas ..... 4 *F. sumatrana*

(4) Small to medium plants, stems (adults) rarely over 11 mm diameter, leaves rarely over 40 cm long; auricles rarely over 5 cm long, usually less than 1 cm wide, truncate, and denticulate or spinulose at apex but never with a free apical lobe.



(6) Median portion of leaf margin denticulate; leaves narrowly linear, commonly about 30 cm × 5 mm. Auricles narrow, truncate, denticulate at apex; blade not narrowed at base ..... 5 *F. confusa*

(6) Median portion of leaf margin unarmed; leaves mostly over 6 mm (and up to 15 mm or more) in width. Auricles entire or spinulose-fimbriate. Leaf blade slightly narrowed at base.

(7) Auricles entire or with few, small inconspicuous teeth. Leaves commonly about 30 × 1–1.5 cm, mostly flat, rather lax. Pedicels of pistillate cephalia smooth or very slightly scabrid. Berry with 2–5 stigmas ..... 6 *F. imbricata*

(7) Auricles deeply fimbriate-spinulose at apex (spinules to 5 mm long), margins denticulate; leaves commonly about 20 cm × 9 mm, stiff, the margins often revolute; abruptly narrowed at base. Pedicels of pistillate cephalia hispidulous. Berry with 1–2 stigmas. .... 7 *F. rigidifolia*

## II. Key to Fertile Specimens

### Based on Pistillate Inflorescences and Fruits

(1) Inflorescences (both ♂ and ♀) racemose, the 3–5 spadices clearly distinct, well-separated, pedicellate ..... 2 *F. angustifolia*

(1) Inflorescences umbellate, usually of 3 crowded pedicellate spadices.

(2) Stigmas usually 2 per berry, sometimes 1 or 3.

(3) Pedicels stout, minutely roughened (like sandpaper to touch) commonly 50 × 5–6 mm. Cephalia to 15 cm long; bracts white. Robust plants ..... 4 *F. sumatrana*

(3) Pedicels slender, 10–40 × 3–4 mm, scabridulous chiefly on the angles. Cephalia 14–35 mm long. Rather small plants.

(4) Auricles deeply fimbriate-spinulose at apex, with spinules to 5 mm long. Bracts red-orange. Leaves stoutly denticulate on basal margins, and abruptly narrowed at top of sheath; up to 8–10 mm wide ..... 7 *F. rigidifolia*

(4) Auricles slightly denticulate; spinules not over 2 mm long. Bracts purplish. Leaves with small teeth; blades about 4–6 mm wide ..... 5 *F. confusa*

(2) Stigmas usually 3–5 (8) per berry, very rarely 2.

(5) Pistillate cephalia oblong. Auricles caducous, sparsely and weakly denticulate or entire.

(6) Leaves oblong, caudate; pedicels slender, 12–16 × 2–3 mm ..... 8 *F. kamiana*

(6) Leaves elliptic-oblong, commonly 10–30 cm long and 12–30 mm wide, nearly entire, only at apex with weakly serrulate-denticulate margins and midribs. Pedicels short and stocky 10 × 3.5–4.5 mm ..... 1 *F. javanica*

(5) Pistillate cephalia subglobose or short-oblong. Auricles subpersistent but fragmenting, entire to weakly or strongly denticulate. Leaves not as above.

(7) Robust plants; stems to 2 cm diameter, leaves to 1 m long and 3.5 cm wide; auricles denticulate, truncate-rounded at apex. Stigmas 4-8 ..... 3 *F. corneri*

(7) Smallish plants, stems to 12 mm diameter, leaves less than 40 cm long, usually 10-15 mm wide; auricles tapered and entire to weakly denticulate. Stigmas 3-5 ..... 6 *F. imbricata*

### Enumeration of Species

(1) ***Freycinetia javanica*** Blume in Rumphia 1: 156, t. 41 (1835). Figure 1, a-b.

Synonymy: *F. lucens* Ridl. in Mat. Fl. Malay Penin. 2: 232 (1907) in Fl. Malay Penin. 5: 80 (1925). *F. montana* Ridl. in Mat. Fl. Malay Penin. 2: 232 (1907) in Fl. Malay Penin. 5: 82 (1925).

Type localities and typification: *F. javanica*: Java (Blume, L). *F. montana*: Perak (*Ridley 5194*, lectotype, SING). *F. lucens*: Singapore (*Ridley 3703*, lectotype, SING).

Distribution: Malaya (including lower Kra Peninsula), Singapore, Sumatra, Java, Borneo.

*Stems* to 11 mm diameter. *Leaves* elliptic or somewhat lanceolate to oblanceolate, abruptly acute, not or scarcely acuminate, narrowed at base, slightly thick-coriaceous, nearly unarmed (only the apex and rarely a short part of the basal margin denticulate); auricles membranous, when fresh colorless and translucent, caducous, tapered or rounded to the apex, entire or weakly and sparsely denticulate, mostly 3-6.5 cm long, and 1 cm wide. *Inflorescence* terminal, umbellate, usually ternate; pistillate pedicels slightly scabridulous on the angles, about 1 cm long, 3.5-4.5 mm thick. *Cephalia* oblong, mostly 2.5-5 cm long. *Berry* 1-1.5 mm long. *Stigmas* 4-8, usually 4-6. *Bracts* orange-salmon color or "Flesh-color" often yellowish. *Staminate cephalia* with whitish stamens, filaments 0.35 mm long, anthers 0.30 mm long.

*Habitat*: in humid forests, commonly montane, ascending to 6,000 ft., but also lower, to 1,000 ft. or even lower especially in the south, as in Singapore (similarly in Sarawak) in well-protected forested humid valleys and along waterfalls. (Low-altitude plants often have unusually wide leaves, while mountain populations mostly show rather short and narrow leaves. Two widely different auricle forms are found, extremes of a continuous series, which correspond to the situations mentioned; see illustrations).

Ridley's distinction between *F. lucens* and *F. montana* appears to be purely imaginary; and he did not distinguish either of these from *F. javanica*. Perhaps Ridley was unfamiliar with Blume's work, although he admitted one of Blume's species of *Freycinetia* (*F. angustifolia*) in the Malayan flora, despite the clear occurrence of three of them (originally described from Java) in the Malayan peninsula.

Malayan specimens:

THAILAND: Pattani, Kao Katakini, Sept. 1923, *Kerr* 7781 (BM, K, L). Kao Nam Sao, 900 m., Feb. 1927, *Kerr* 12053 (BM, K). Kao Luang, N. Sritamarat, 1,200 m., April 1928, *Kerr* 15488 (BM).

MALAYA: PERAK: Maxwell's Hill, June 1893, *Ridley* 5194 (lectotype of *F. montana*) FI, SING. Same loc., 1892, *Ridley* (SING). Larut, Dec. 1881, *King's collector* (i.e. *Kunstler*) 2619 (FI, SING); 4003 (FI, SING); 4091 (FI, SING); May 1883, 4194 FI, SING). Thaiping, Feb. 1886, *Kunstler* 8523 (FI); May 1885, *Kunstler* 7578 (FI, SING); April 1890, *Wray* 3950 (FI); Pelan Tujer, April 1888, *Wray* 1871 (FI). Larut, *Fr. Scortechini* (FI, 8 sheets). Maxwell's Hill, 3,700 ft., coll.? SFN. 12557 (SING). Gunong Hijau, 1892, *Ridley* (SING).

TRENGGANU: Bukit Kajang, Kemaman, Nov. 1935, *Corner* (SING).

PENANG: Sungei Telek Bahang, Feb. 1919 (or 1929) *Burkill* 4555 (CALC).

PAHANG: Lubok Tamang, 3,500 ft., June 1923, *Robinson* 11009 (SING). Cameron Highlands, Robinson's Falls, April 1930, 4,400 ft., *Henderson* SFN. 23454 (CALC, K, SING); April 1934, *Jaamat & Sow* CF. 36165 (KEP); May 1965, *Stone* 5623 (KLU). Gunong Benom, main NE ridge, 3,200 ft., March 1967, *Whitmore* FRI. 3205 (KEP). Fraser's Hill, 4,000 ft., Aug. 1923, *Nur* SFN. 10550 (SING); Aug. 1937, *Holtum* 33162 (K); near Richmond Bungalow, 1959, *Md. Shah* 6048 (K); Aug. 1937, *Corner* SFN. 33162 (SING); Sept. 1922, *Burkill & Holtum* 8546 (SING); April 1966, *Stone* 6273 (KLU); July 1966, *Stone* 6421 (KLU). Sungai Kuantan, June 1934, *Symington & Kiah* SFN. 28771 (K, SING). Gunong Ulu Kali, 1967, *Stone* s.n. (KLU).

SELANGOR: "The Gap" at 3,000 ft., May 1902, *Curtis* (SING). Bukit Hitam, May 1896, *Ridley* 7657 (FI, SING). Templer Park, Kanching 1967, *Stone* s.n. (KLU). Gunong Nuang, Ulu Langat, May 1940, *Symington* 51813 (KEP).

NEGRI SEMBILAN: Seremban, April 1892, *Edgerton* (SING).

MALACCA: no location, 1867–8, *Maingay* 3274 (K).

JOHORE: Kukut, Easter 1907, *Ridley* (SING). Mawai, March 1934, *Corner* (SING). Sungei Sedili, Feb. 1938, *Corner* (SING). Pontian, April 1952, *Santiago* (SING).



SINGAPORE: Kranji, *Ridley* in 1890 (SING); Bukit Mandai, 1890, *Ridley* 4618 (FI, K, SING). Bukit Timah, 1892, *Ridley* 3703' (lectotype of *F. lucens*) FI, K, SING. Seletar, May 1953, *Sinclair-SFN*. 39616 (SING, K).

MALAYA, without locality: *Griffith* 6374 (FI); *Maingay* 1537 (K).

(2) *Freycinetia angustifolia* Blume in Rumphia 1: 157, t. 40 (1835)..

Ridley, Fl. Malay Penin. 5: 82 (1925).

Synonymy: *F. malaccensis* Ridley in Mat. Fl. Malay Penin. 2: 233 (1907); in Fl. Malay Penin. 5: 81 (1925). *F. brunoniana* Wallich (nom. nud.) List, n. 3660 (1828–32). *F. debregeasiana* Gaudich. in Bot. Voy. Bonite, Atlas, t. 37, f. 1–11 (1843).

Type localities and typification: *F. angustifolia*: Java (Blume, L). *F. malaccensis*: Malacca (lectotype, *Derry* 406, SING). *F. debregeasiana*: not stated, but possibly Singapore (*Gaudichaud* in 1837; P? fragment in FI).

Distribution: Malaya, Sumatra, Java, Borneo, Philippines.

Vernacular name: “selingseng akar” (Malay; Johore, *Corner* 28074).

*Stems* 6–12 mm diameter. *Leaves* linear, slender, thin, 17–20 cm long, 5–12 mm wide, gradually attenuate, very slightly acuminate, unarmed except at extreme apex. Auricles 15–20 mm long, caducous, entire, fragile. *Inflorescences* racemose, rachis sometimes somewhat zig-zag, pedicels well-separated; bracts dark to pale yellow or yellow-range, sometimes flecked with red on inner surfaces, innermost bracts creamy, outermost with green tips; pistillate cephalia on pedicels 9–11 × 1.5–2 mm, glabrous, whitish; cephalia shortly cylindric, 23–33 mm long, at first cream-colored; berry 1 mm long. Stigmas 1–3, rarely 4, very rarely 5. Staminate spadix 1–2 cm long, white. Seed with broad raphe and no strophiole.

Habitat: low hill forest, chiefly in the southern and western parts of the peninsula; also in lowland swamp forest; also on offshore islands.

Ridley's *F. malaccensis* was characterised by its relatively broad leaves, but examination of numerous specimens shows that continuous variation, within the limits given above, occurs; and there are no other distinguishing features.

MALAYA: PENANG: *George Porter* in 1823 (“*F. brunoniana* Wall.” n. 3660) Fl. “Coast” March 1887, *Curtis* 1181-bis (SING), 1171 (K); Dec. 1886, *Curtis* 1143 (SING). Penang Hill, Dec. 1895, *Ridley* (SING). Telok Bahang, Feb. 1919, *Burkill* 4555-bis (CALC, SING).

PERAK: Sonkai, May 1882, *Kunstler* 3052 (FI, SING). Keledang Saiong, April 1937, *Symington* 25557 (KEP).

SELANGOR: Klang, Telok Reserve, June 1921, *Burkill* 6518 (SING).

NEGRI SEMBILAN: Pulau Rembia (Sembilan Islands), along streambed 100 ft. Jan. 1953, *Wyatt-Smith* 76493 (KEP). Bukit Kandong, March 1885, *Omabius* (? sphalm.) 1117 (SING).

MALACCA: Mt. Ophir, 1892, *Ridley* 3895 (FI, K, SING). Bukit Bruang, Feb. 1890, *Derry* 406 (lectotype of *F. malaccensis* Ridley; miscited by Ridley as "Ridley 406", FI, SING); March 1893, *Derry* 1197 (FI, SING; det. by Ridley as *F. angustifolia*). Merlimau, 1892, *Derry* 1046 (FI — as "Ridley 1046"; SING).

JOHORE: Sungei Tebrau, March 1908, *Ridley* 13212 (SING). Pengabong May 1908, *Foxworthy* CF 1200 (KEP, SING). Kangka Sedili Kechil, June 1924, *Corner* SFN 28617 (CALC, K, SING). Sungei Sedili, April 1934, *Corner* SFN 28074 (K, SING). Kota Tinggi riverbank Dec. 1892, *Ridley* 4142 (K, SING). Mawai Road — Kota Tinggi, March 1936, *Corner* SFN 30784 (SING). Sungei Sedili between Mawai and Bukit Tiga, March 1937, *Corner* SFN 32435 (SING). Sungei Kaipu, March 1937, *Kiah* SFN 32354 (L, SING). Sungei Sedili, March 1940, *Corner* (SING). Gunong Panti, 1,500 ft., Jan. 1937, *Corner* SFN 32216 (L, SING). Kuala Sedili Road in freshwater swamp forest, May 1961, *H.M. Burkill* 2667 (L).

SINGAPORE: Bukit Mandai, 1890, *Ridley* 1643 (SING). April 1921, *Burkill* 6507 (SING). Bukit Timah, 1893, *Ridley* 5120 (SING). Sungei Buloh, Nov. 1889, *J.S. Gamble* (SING). Kranji, 1909, *Ridley* 14176 (CALC, K, SING). Seletar Reservoir, Feb. 1943, *Corner* (SING); Jan. 1949, *Sinclair* (L). Without locality, *Gaudichaud*, in 1837 (Herb. Delessert, Geneva; fragm. FI; P; type of *F. debregeasiana* Gaud.).

MALAYA, without definite locality, *Maingay* 1537/2 (FI, K, L).

(3) *Freycinetia corneri* B. C. Stone, *Brittonia* 20 (1968) 198–202. Plate II.

Type locality: Singapore (*Corner*).

Distribution: Malaya (Johore, Selangor), Singapore, and Borneo.

Robust climber, *stems* to 20 mm diameter; *leaves* to more than 1 m long, 2–3.5 cm wide, linear, apex acute, sheathing base 9–10 cm long, blades coriaceous; auricles to 9 cm long (at least), 1–2 cm wide, the apex abruptly truncate-rounded (rarely almost lobate), the sides usually entire but the apex ciliate-spinulose. Leaf-margin stoutly and rather remote dentate, the teeth deltoid and spreading at right angles to the margin, the lowermost ones nearly 2 mm long, up to 1.9 mm wide, about 1 cm apart, distally the teeth smaller. Midrib denticulate from the middle beyond, the teeth at most up to 1.9 mm wide, about 1 cm apart, distally the teeth smaller. 2 mm long, smaller toward the apex. *Inflorescence* terminal, ternate, umbellate, the pedicels (♀) about 60 × 5–7 mm, plano-convex,



Plate I. *Freycinetia sumatrana* in the Ginting Highlands, Pahang.



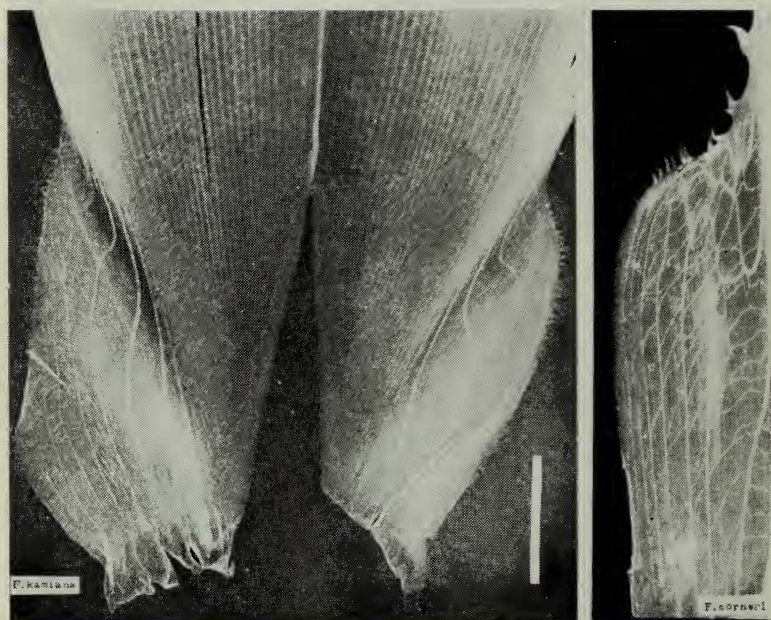


Plate II. Freycinetia auricles. Left, *F. kamiana*. Right, *F. corneri*. White bar is 1 cm long.



subtrigonal, smooth. Bracts deltoid, to 6 cm wide or more, probably reddish. Pistillate cephalia about  $45 \times 40$  mm, subglobose. Berry oblong, about  $14 \times 3$  mm, the pileus 4 mm long, narrowly pyramidal, apex truncate. Stigmas usually 4–8 (very rarely 3), minute, hippocrepiiform. Staminate spadix on pedicels to 60 mm long, spikes ternate or quaternate, cylindric, the floriferous part about  $30 \times 8$  mm, filaments 1.5 mm long, anthers 0.75 mm long.

Habitat: lowland forests. A species of restricted range, only discovered among Bornean specimens after being described from the Singaporean material (see citation of Borneo specimen below).

MALAYA: JOHORE: near Kota Tinggi, Feb. 1938, *Corner SFN 34672* (K, PNH, SING). Mawai-Jemaluang Rd. 14th mile, April 1938, *Corner SFN 34938* (SING). Gunong Pantii, 1780 ft., June 1963, *Stone 4834* (L).

SELANGOR: Sungei Lallang F. R., *Y. K. Kam s.n.* in 1967 (KLU).

SINGAPORE: Seletar forest, behind vegetable gardens, Nee Soon, Jan. 1949, *Sinclair* (K). Seletar Reservoir, Feb. 1943, *Corner* (SING, type!).

BORNEO: Central East Indonesian Borneo, W. Koetai, n. 39, Mt. Kemoel, 1800 m., 21 Oct. 1925, *Ender 4453* (L.). (New distribution record).

To date the species is known only from the specimens cited.

(4) *Freycinetia sumatrana* Hemsley in Kew Bulletin, 167 (1896). Plate I; figures 1, c–d; 2; 3, a–b.

Synonymy: *F. valida* Ridley in Mat. Fl. Malay Penin. 2: 233 (1907); in Fl. Malay Penin. 5: 83 (1925). Winkler in Engl. Bot. Jahrb. 48: 87 (1912); Merrill, Bibl. Enum. Bornean Pl. 34 (1921).

Type localities and typification: *F. sumatrana*: Sumatra (*Beccari*, K). *F. valida*: Singapore (lectotype: *Ridley 3937*, SING).

Distribution: Sumatra, Malaya, Borneo, Philippines, Andaman Is.

Robust climbers with stems to 18 mm diameter (or more); leaves linear, gradually attenuate, commonly 45–110 cm long, 1–3 cm wide, margins denticulate nearly all along their length with relatively slender usually antrorse teeth. Auricles purplish, subpersistent but fragmenting, 4–8 (–18) cm long, 1–2 cm wide, with a distinct erect-spreading denticulate apical lobe to 1 cm long; auricle margins entire to denticulate. Inflorescence terminal, umbellate, ternate; bracts creamy to pure white, outermost ones sometimes tinged pinkish dorsally; pistillate cephalia cylindric, up to  $15 \times 4$  cm, more often  $5\text{--}10 \times 2\text{--}3$  cm, dull red when ripe, on pedicels about  $40\text{--}55 \times 4\text{--}6$  mm, costulate, finely roughened-scabridulous. Berry very slender, to 20 mm long. Stigmas as a rule 2 per berry, very rarely 1 or 3. Staminate spadix creamy-white, spikes 6–7.5 cm long, 1.35 cm wide.

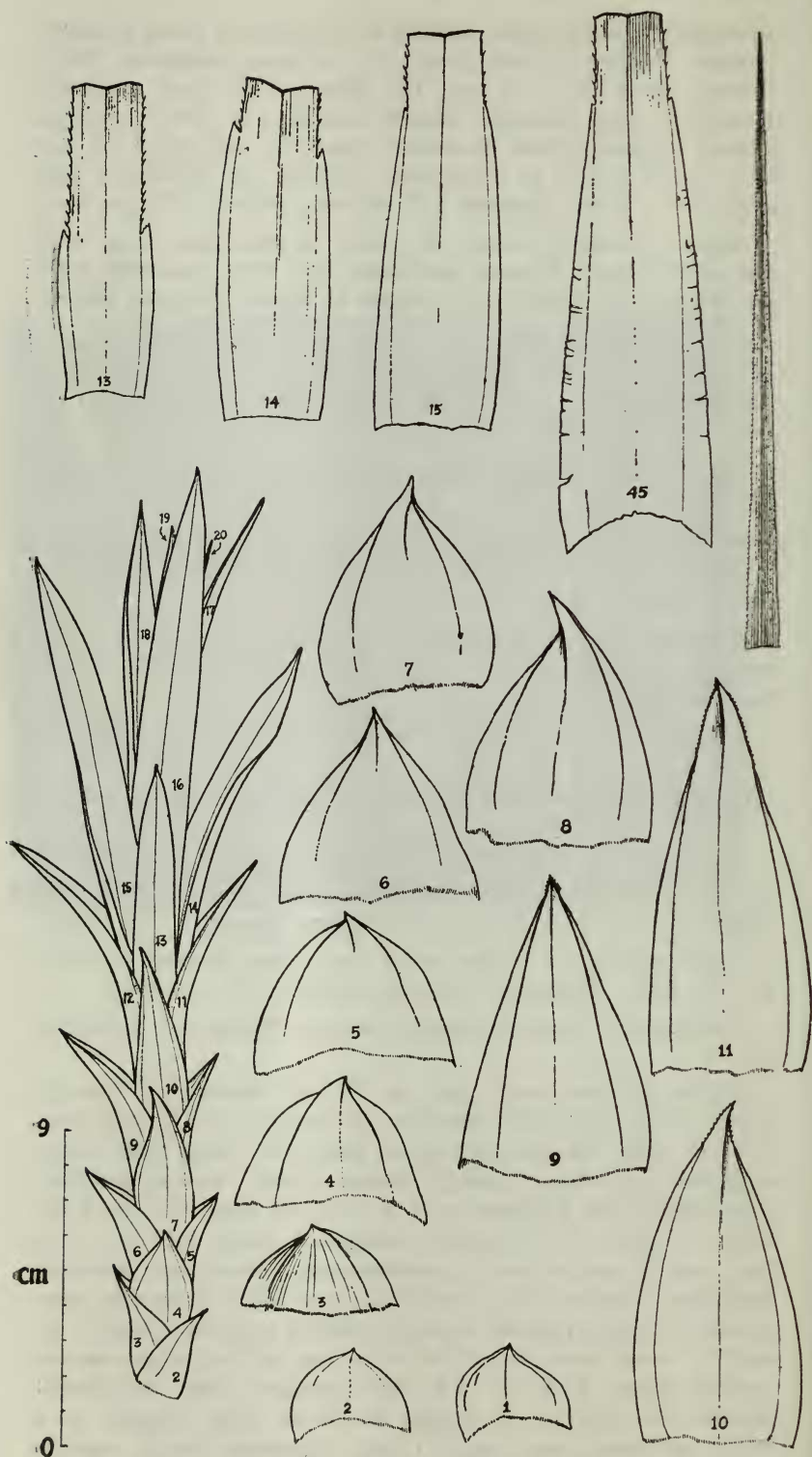


Fig. 2. Leaf spectrum of *Freycinetia sumatrana* var. *penangiana*. Prophylls and leaves in numbered sequence; 1st prophyll, no. 1; prophylls 2 through 8 all unarmed; intermediate prophylls 9-11 with denticulate apex; foliage leaves 12-et seq. Leaf bases of leaves 13, 14, 15, and 45, and leaf apex of leaf 45, shown. (All from

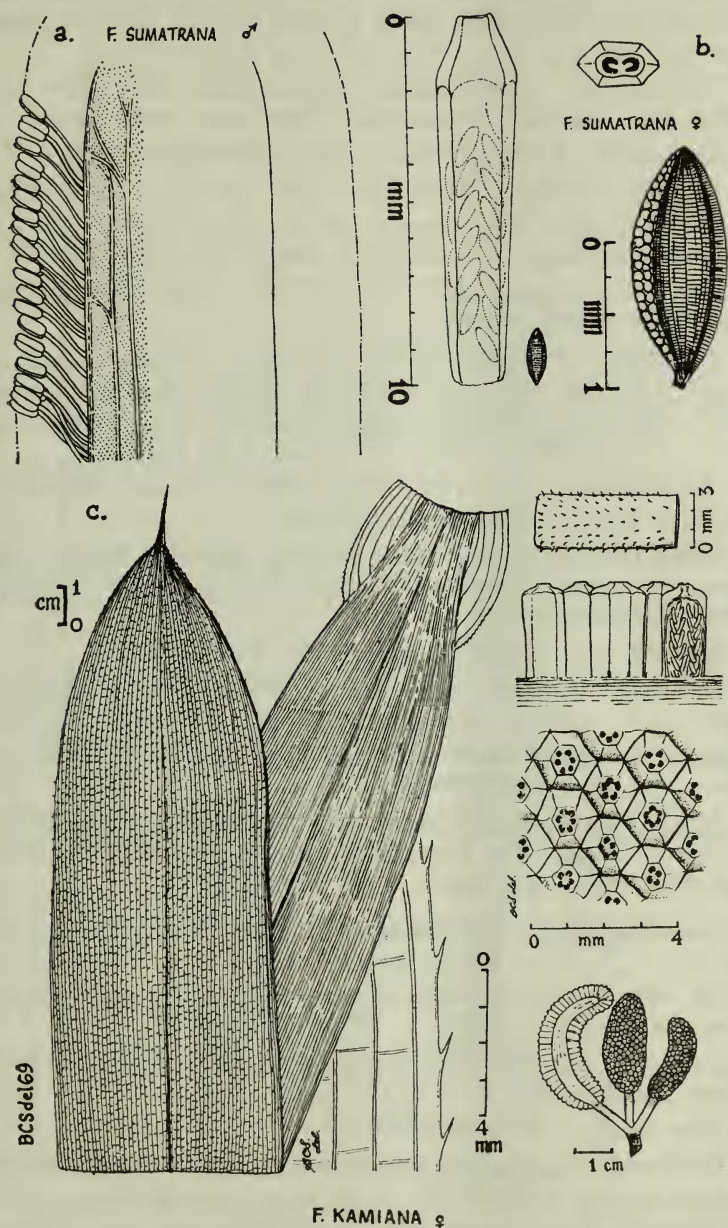


Fig. 3. a-b, *Freycinetia sumatrana*. a — detail of apex of staminate spadix. b — details of berry and seed. c — *Freycinetia kamiana* (from holotype). Left, leaf with enlarged inset of marginal teeth. Right, above: segment of fruiting pedicel; profile of immature carpels; top view of same. Below, pistillate inflorescence, with one cephalium in longisection.

Habitat: In Malaya, in forests from the lowlands to about 6,000 ft., the high montane forms are smaller, and often have leading shoots of a deep purplish color throughout. Younger plants and lowlands plants are often sterile for long periods. Montane plants may produce fruit of a normal color but devoid of seed.

THAILAND: Kao Katakini, Pattani, Sept. 1923, *Kerr* 7792 (BM) Kao Katakuan, 200 m. March 1930, *Kerr* 18510 (B M).

MALAYA: KEDAH: Turton, Nov. 1889, *Curtis* (SING).

PERAK: Thaiping Hill, Feb. 1904, *Ridley* 11891 (SING); *Wray* 2170 (FI). Batu Togoh, 300 ft., *Wray* (7108?) (SING). Birch's Hill, March 1924, *Burkill & Haniff SFN* 12674 (SING).

PENANG: Penang Hill, 2,400 ft., 1901, *Curtis* 3538 (SING); Feb. 1892, *Ridley* (SING).

PAHANG: Cameron Highlands, Lubok Tamang, 3,000 ft., April 1937, *Nur SFN* 32953 (KEP, K, SING). May 1965, *Stone* 5625 (KLU). Oct. 1966, *Md. Kassim* (KLU). Fraser's Hill, Aug. 1937, *Corner* (SING). April 1966, *Stone* 6289 (KLU).

SELANGOR: April 1890, *Ridley* (SING). Ginting Highlands, 3,200 ft., Nov. 1966, *Stone* 6568 (KLU).

NEGRI SEMBILAN: Pulau Rembia, Sembilan Islands, Jan. 1953, *Wyatt-Smith* 76442 (KEP). Port Dickson, Sungei Menyala, 1957, *Whitmore* 300 (K).

MALACCA: Gunong Ledang, 1892, *Ridley* (SING).

JOHORE: Mukub, 1908, *Ridley* (SING). Gunong Belumut, May 1923, *Holttum SFN* 10822 (K, SING). Kluang, Gunong Belumut, 3,300 ft., Feb. 1966, *Francis Ng*, 98059 (KEP). Mt. Ophir, May 1890, *Derry* 627 (SING).

SINGAPORE: Bukit Mandai, Aug. 1899, *Ridley* 10439 (SING). Gardens' Jungle, Chua Chu Kang, 1892, *Ridley* 3937 (*F. valida*, lectotype, SING). No locality, 1905, *Ridley* (SING).

**F. sumatrana** Hemsl. var. **penangiana** B. C. Stone, var. nov. Figures 1d; 2.

Ab var. *typica* in auriculis angustioribus attenuatis minute truncatis nec lobatis differt.

Holotype: SELANGOR: Templer Park, Kanching, June 1965, *Stone* 5809 (KLU).

Type locality; *Stone* 6040 (KLU).

PENANG: Penang Hill, Jan. 1901, *Curtis* 3538 (SING). Upper Tunnel Station, 2,000 ft., Feb. 1966, *Stone* 6138 (KLU).

KEDAH: Turton, Nov. 1889, *Curtis* (SING, in part).

ANDAMAN ISLANDS: 1875, *Kurz* (FI).

This variety may be a local form, or merely a state of growth. The narrow auricles, commonly 8–10 cm long, but sometimes to 18 cm long, with a long taper but an abrupt though very brief truncation at the apex, without a lobe, and with minutely denticulate margins and a purplish color, seem to be very characteristic.



- (5) ***Freycinetia confusa*** Ridley in Mat. Fl. Malay Penin. 2: 234 (1907); in Fl. Malay Penin. 5: 82 (1925). Figure 1, f.

*Not F. confusa* Elmer 1907 (renamed by Elmer as *F. villarii* 1908).

Type locality: Singapore (lectotype, *Ridley 4757*, SING).

Distribution: Singapore and Malaya, apparently endemic, but very similar to and possibly not distinct from *F. distigmata* Stone of Sumatra, which is however a later name than *F. confusa*.

Slender climber with *stems* to about 5 mm diameter, *leaves* linear, gradually attenuate, 30–33 cm long, 4–5 mm wide, the margins denticulate. Auricles 25–32 mm long, 4 mm wide, slightly tapered, the apex briefly truncate, minutely spinulose-ciliate; sides entire. *Inflorescence* terminal, umbellate, usually ternate; pedicels of pistillate cephalia scabridulous, 11 × 4 mm; pistillate cephalia (immature) 14 mm long. Berry (immature) 1 mm long; stigmas 1 or 2 per berry. Staminate inflorescence unknown.

Habitat: Lowland forests.

In his original description, Ridley cited *Wray 2151* as a syntype of *F. confusa*, but this specimen is actually *F. rigidifolia* (see under that species). Because of this Martelli confused the species and in FI almost all specimens of *F. rigidifolia* were marked *F. confusa*. Ridley cited *Wray 2151* as *2157*, by mistake.

MALAYA: SELANGOR: Changgang Klang, Oct. 1937, *Nur SFN 33982* (SING).

JOHORE: Pengkalan Raja, July 1939, *Ngadiman* (SING).  
Mawai, April 1936, *Corner SFN 30886* (SING).

SINGAPORE: Seletar, Feb. 1893, *Ridley 4757* (lectotype, SING). Kranji, 1894, *Ridley* (SING).

- (6) ***Freycinetia imbricata*** Blume in Rumphia 1: 157, t. 40 (1835).

Synonymy: *F. schefferi* Solms-Laubach in Linnaea 42: 98 (1879). *F. kingiana* Ridl. in Mat. Fl. Malay Penin. 2: 234 (1907); in Fl. Malay Penin. 5: 82 (1925).

Type localities and typification: *F. imbricata*: Java (*Blume 2066*, L). *F. schefferi*: Java (*Scheffer; Korthals*). *F. kingiana*: Perak, Malaya (*Kunstler 4654*, SING).

Distribution: Malaya, Sumatra, Java, Borneo.

Smallish to medium climbers, *stems* to 12 mm diameter, *leaves* mostly 20–35 cm long, 6–15 (–17) mm wide, rarely to 24 mm wide, narrowly elliptic-oblong to nearly linear-lanceolate, usually slightly narrowed at base, acuminate-acute at apex; margin denticulate near base and apex, otherwise entire. Auricles more or less persistent and clasping the stem, tapered-rounded at apex, membranous, entire or weakly and sparsely denticulate, usually 2–5 (–7) cm long, 4–6 (–9) mm wide. *Inflorescence* terminal or pseudolateral (i.e. on short side branches with a few reduced leaves intercalated

below the bracts). Bracts yellow to creamy. Pistillate cephalia globose or broadly short-ellipsoid, 25–45 mm long or rarely more, bright orange when ripe; on pedicels 9–10 × 3.5 mm, glabrous or (in var. *hispidula*) minutely hispidulous. Berry to 10 mm long, pileus 1.5–2 mm long, dome-shaped or low-conic, briefly or not rostrate, areola less than 1 mm wide; stigmas 1–5, usually 3 or 4. Seeds about 1.3 mm long, falcate-ellipsoid, raphe with shining raphidophorous cells, usually broader than the narrow strophiole. Staminate spadix . . .

Habitat: lowland forests, sometimes on rocks.

MALAYA: PERAK: Gopeng, Larut, July 1883, *Kunstler 4654* (lectotype of *F. kingiana*, SING; FI). 1880, *Kunstler 1056* (FI, SING). June 1886, 400–600 ft., *Kunstler 10165* (FI).

***F. imbricata* var. *hispidula*** B. C. Stone, var. nov.

Ab var. *typica* in pedicellis foemineis hispidulis differt.

Holotype: MALAYA: SELANGOR: Genting Sempah, 1,500 ft., on rock, July 1966, *Stone 5847-a* (KLU).

SELANGOR: Same as type locality, June 1965, *Stone 5847* (KLU). Ginting Highlands, 3,000 ft., Nov. 1966, *Stone 6535* (KLU). Ulu Langat, Jan. 1959, *Gadon* (for Millard) 1327 (SING).

PAHANG: Fraser's Hill, 4,000 ft., Nov. 1965, *Stone 6078* (KLU).

JOHORE: Mawai, Sept. 1934, *Corner SFN 28181* (K, SING). Sungei Kayu, March 1937, *Kiah SFN 32380* (K, SING).

I believe that this variety with hispidulous pedicels and perhaps mostly somewhat broader leaves, is the same as *F. schefferi* Solms. It is not possible to keep the taxa as distinct species however.

(7) ***Freycinetia rigidifolia*** Hemsley in Kew Bulletin, 166 (1896).

Figure 1, e.

Synonymy: *F. acuminata* Ridley in Mat. Fl. Malay Penin. 2: 233 (1907); in Fl. Malay Penin. 5: 82 (1925). *F. bennettii* Miq. as misapplied in Hort. Bogor., in part, excluding ref. to spms. of *F. javanica*.

Type localities and typification: *F. rigidifolia*: Borneo (*Haviland*, K). *F. acuminata*: Malaya, Selangor (*Ridley 7656*, SING).

Distribution: Borneo, Malaya, Andaman Islands; cult. in Hort. Bogor.

Slender climber, with stems "to 80 ft. long" (fide *Kunstler*), to 6 mm diameter or more; leaves stiff, 16–24 cm long, 8–10 mm wide (Malayan specimens), elliptic-lanceolate, acute-acuminate, narrowed rather abruptly at base just at apex of auricles, margins often revolute, blades rather stiffly erect. Auricles abruptly rounded-truncate, deeply fimbriate with spinules 5 mm long or more at apex,

the sides with shorter teeth; auricles  $25 \times 5$  mm. Blade margin at base stoutly denticulate; median part unarmed; apex finely denticulate. Dorsal surface somewhat glaucous. *Inflorescence* terminal, umbellate, ternate; bracts red or red-orange. Pistillate cephalia greenish-yellow (immature), cylindric, to 35 mm long; pedicels scabridulous on the angles, about  $30\text{--}40 \times 4$  mm. Berry (immature) 1 mm long; stigmas 1 or 2.

Habitat: lowland or hill forest (in Borneo on Mt. Kinabalu to 5,000 ft. or higher).

A very distinct and easily recognised species.

ANDAMAN ISLANDS: South Andaman, 1909, *Rogers* (FI). Same locality, *Kurz* (in part; mixed with some specimens of *F. sumatrana*; FI).

MALAYA: PERAK: Batu Tugoh, 200 ft., June 1888, *Wray* 2151 (cited — in error as 2157 — by Ridley as a syntype of *F. confusa* Ridl.) (SING). Same locality, 300–800 ft., Nov. 1885, *Kunstler* 8300 (FI).

TRENGGANU: Bukit Kajang, Kemaman, Nov. 1935, *Corner* SFN 30406 (SING).

PAHANG: Fraser's Hill, Aug. 1937, *Corner* (SING).

SELANGOR: Kuang, May 1892, *Ridley* 7656 (lectotype of *F. acuminata*) (SING). Sungei Buloh, April 1929, *Sow and Taehan* SFN. 16447 (SING); same locality, March 1919, *Long* CF 3307 (SING). Bukit Lagong, July 1965, *Kochummen* 93141 (KEP).

JOHORE: Mawai-Jemaluang Road 13.5 miles, May 1935, *Corner* SFN 29738 (SING).

(8) *Freycinetia kamiana* B. C. Stone, *sp. nov.* Figure 3, c; plate II.

Holotype: Y. K. Kam *s.n.*, Bukit Lagong, Selangor, Malaya (KLU).

Stipite erecta ad 2–2.5 m alta et 18 mm diametro, internodiis ad 4 cm longis, simplex vel sparse ramificata, ramis horizontalibus vel laxe subpendulis vel decumbentis, ad 5–8 mm diametro, internodiis 5–20 mm longis, nodis vetustioribus cicatricosis. *Folia* juvenilia magna ad 40 cm longa et 6 cm lata, oblonga vel oblonge-lanceolata, basi 3 cm lato, apice abrupte rotundata caudato, caudo 15–28 mm longo; auriculis ad 35 mm longis et 10 mm latis, rotundato-attenuatis margine minute distaliter denticulato, membranaceis. *Folia* vetustiora simillima sed parviora ad 18–30 cm longa et 2–4 cm lata, marginibus (apicem versus in caudo excepta) inermis. *Inflorescentia* foeminea terminalis, ternatis, pedicellis 3, ad 12–16 mm longis et 2–3 mm crassis, supra minute sparseque hispidulis. Cephalia oblonga vel cylindric ad 5 cm longa, 1 cm lata, curvata, baccis immaturis congestis 5–6-angulosis, circiter 5–6 mm longis, 1–1.5 mm crassis, pileo depresso-pyramidato coronatis; stigmatibus 3–5–(7). Cetera ignota.